2012

House Select Committee on Energy Independence and Alternative Fuels

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Power and productivity for a better world™

Agenda

- Who is ABB?
- Current State of Power Grid
- Renewables and Energy Storage
- Microgrids
- Conclusion

A leader in power and automation technologies
Facts about ABB in North America

- ABB currently employs more than 1,600 in North Carolina:
  - 375 in Raleigh
  - 275 in Cary
  - 225 in Pinetops (Edgecombe County)
  - 750+ in 3 inherited Baldor (NC) factories in Weaverville, Kings Mountain, Marion, and most recently, Shelby
  - 100+ will be employed in Huntersville upon 2012 opening
- ABB's North American (NA) corporate headquarters is in Cary, NC (Regency Park). ABB moved the headquarters to Cary in April, 2009 from Norwalk, Connecticut.

Largest installed base of ABB power transmission and distribution equipment

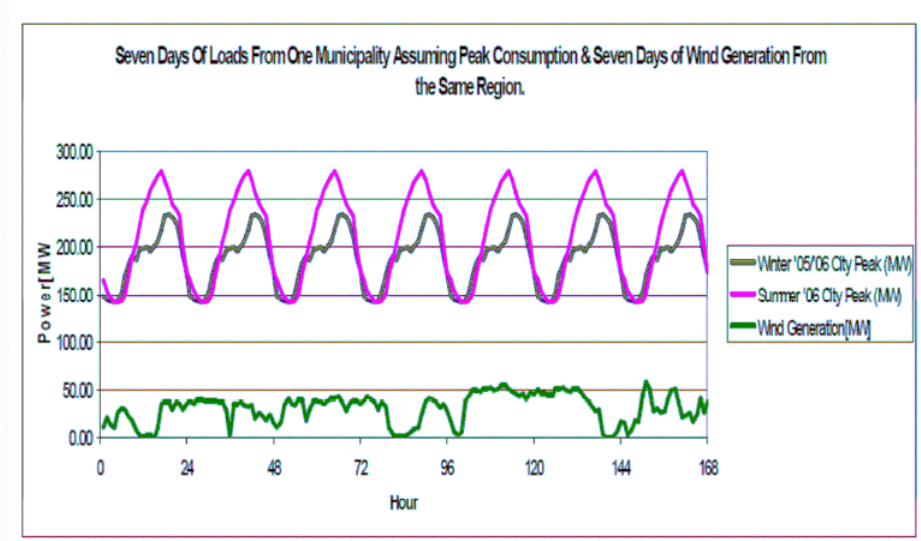
One of company's largest markets for products, systems and services

- Discrete Automation and Motion
- Low Voltage Products
- Power Products
- Process Automation
- Power Systems

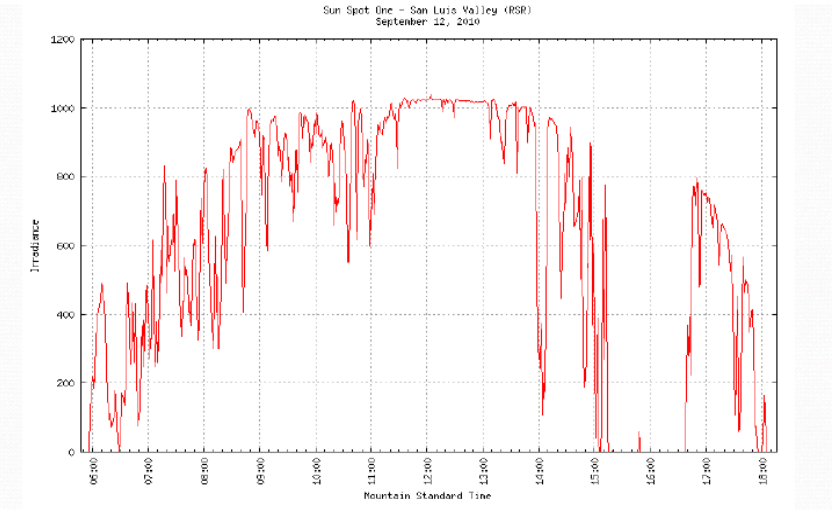
- Region headquarters in Cary, North Carolina
- Nearly 19,000 employees working in Canada, Mexico and the United States
- Five major operational areas: Manufacturing, Assembly, Service, Sales and engineering, Research & Development

North America footprint

Energy Storage
Renewables – Reducing Variability

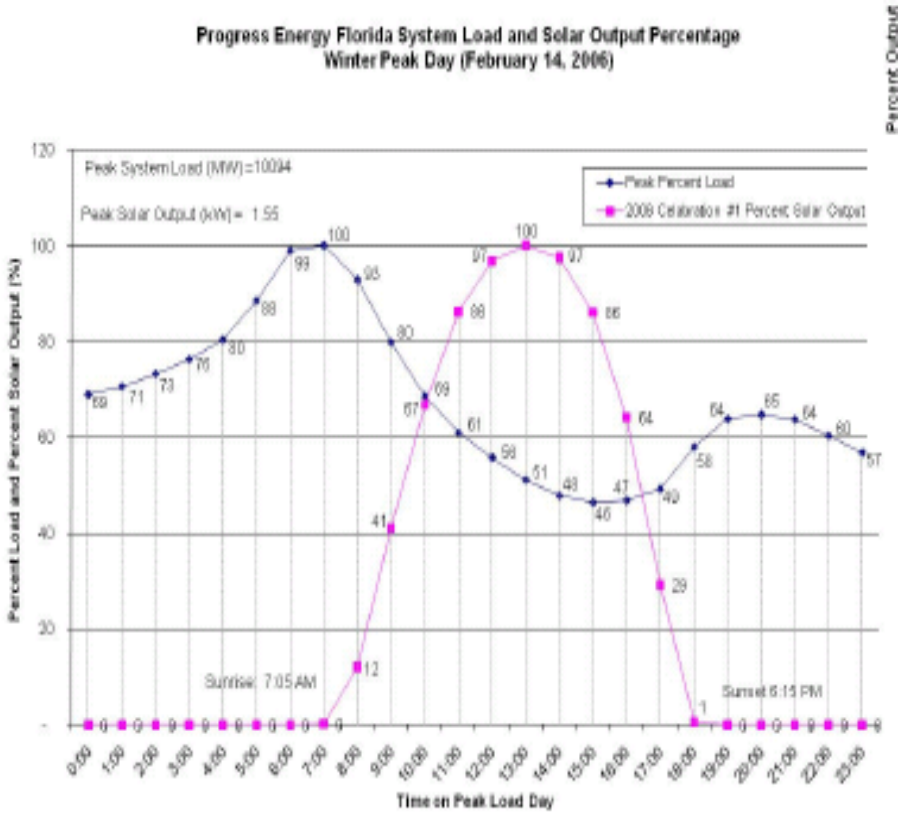


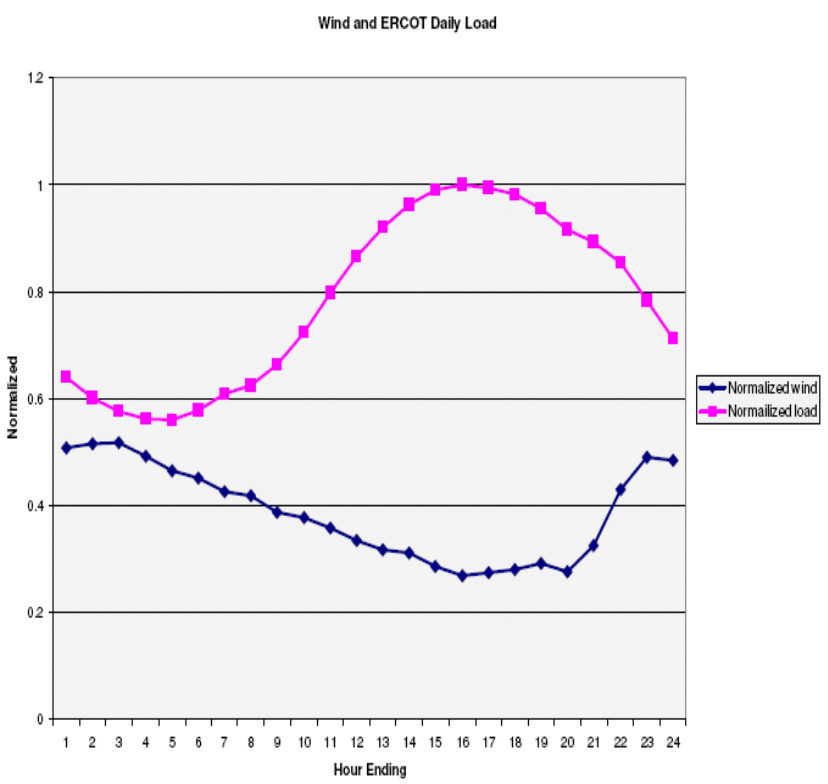
San Luis Valley Solar Data (09/12/2010) Bad Day [1]



- US government targets 20% of power generation to be renewable by 2020
- Variability
  - Generates stress on the fossil generation assets
  - Jeopardizes system stability
- Generation > Demand + Reserve

Energy Storage
Renewables – Wind/Solar Generation Peaks

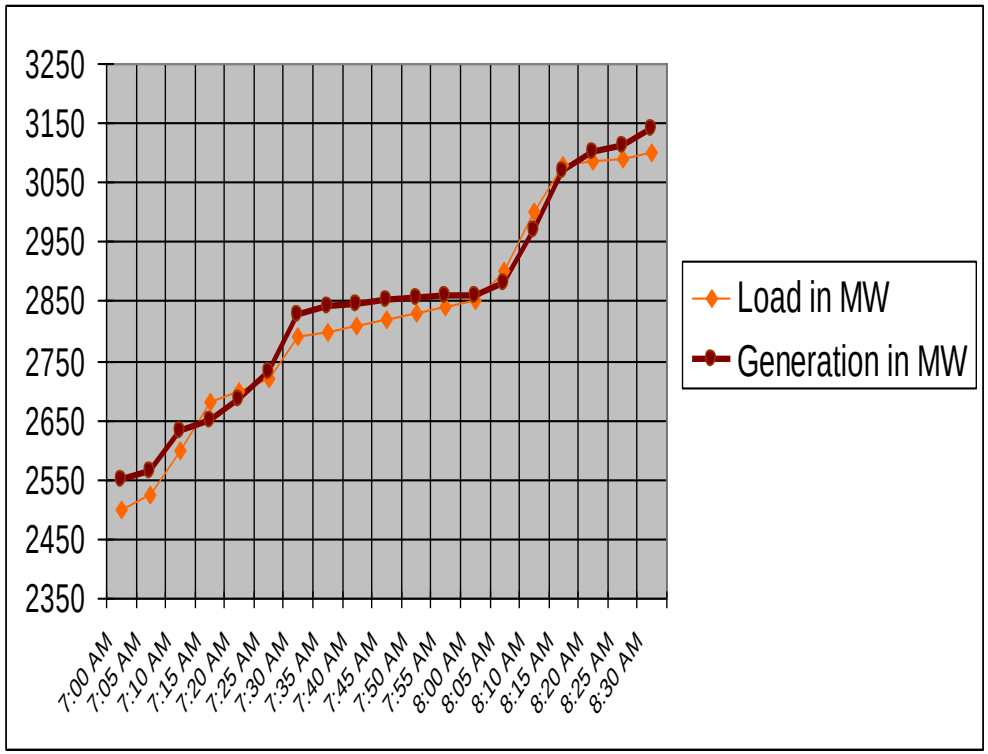


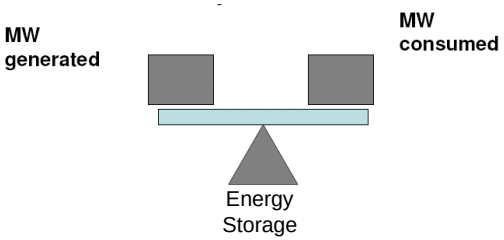


- US government targets 20% of power generation to be renewable by 2020
- Wind and solar generation peaks do not align with demand peaks

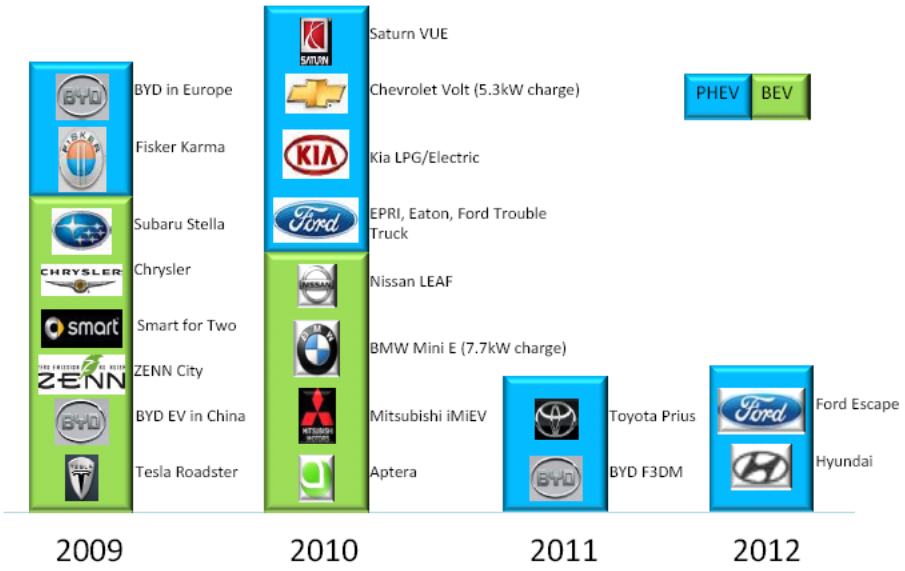
Energy Storage
Generation & Consumption: Balancing challenge

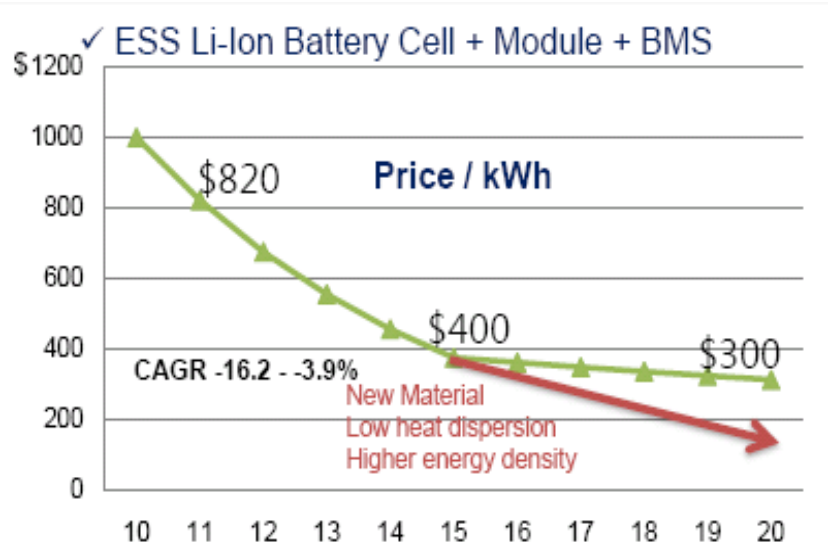
- Balancing generation and load instantaneously and continuously is difficult because the loads and generator are constantly fluctuating
- Energy Storage regulates and balances





Energy Storage Drivers
Roll Out of Electric Vehicles





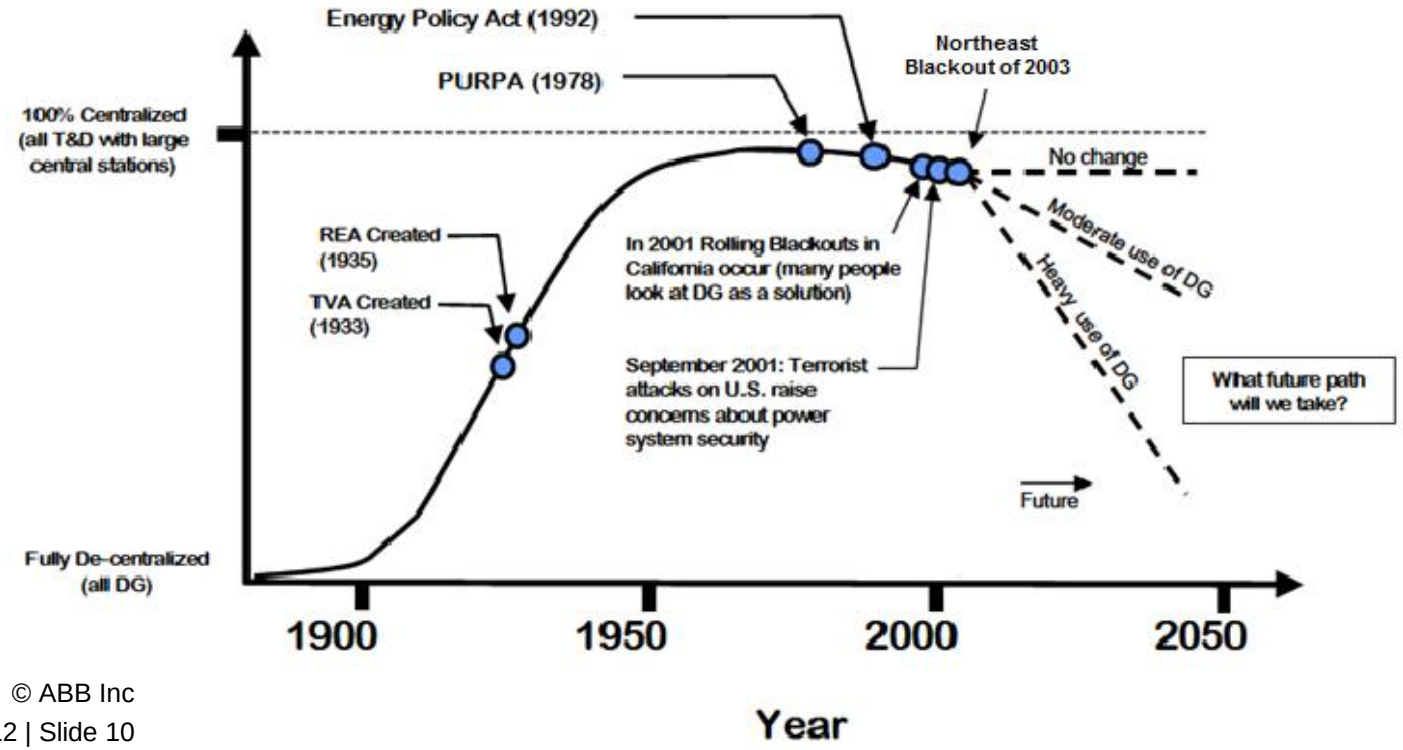
- Good news and Bad:
- Electric vehicle charging will add stress to the distribution system
  - Centralized systems are inflexible and EV's add variability to consumption
- Electric vehicle roll out will increase the volume of batteries being manufactured thereby reducing the cost of battery energy storage solutions

Energy Storage Drivers
Government Incentives

- **AB 2514 -** California Assembly passed the bill AB 2514 that set a deadline by 2012 to set objectives for the utilities to invest in energy storage projects (all technologies).
- **Storage act (1091 – pending) –** Will amend tax codes to create incentives for energy storage deployment.
- **SGIP (Self generation Incentive program) -** Provides financial incentives (2 USD/watt) for installation of storage (behind the meter) combined with wind turbines and fuel cells.
- **EISA 2007 –** Requires council to develop a 5 year plan (by Dec 2009) for storage as a tool to manage variability and capacity concerns. Directs DOE to conduct a cost sharing R&D
- **ACELA (1462) –** Peak demand reduction and load shifting goals with tools like demand response technologies (smart grid technology, dynamic pricing, distributed generation, energy storage)

History of the Electric Grid

- Microgrids were the dominant form of electric power systems during the first two decades of the 20th century, and as late as 1918 about half of the customers in the country (in most towns and small cities) were still receiving their power from small-scale isolated power systems with generation plants sized well under 10MW.
  - Starting with Thomas Edison's Manhattan Pearl Street Station in 1882.
- Between 1910 and 1920, various technological innovations and other factors set in motion the movement away from the early microgrids and towards a system based upon increasingly larger-scale central-station plants interconnected via transmission lines.
  - These factors included developments of large-scale hydro electric resources located significant distances from load centers, newly developed T&D technologies, larger generation facilities built to take advantages of significant economies of scale, and improved load factor through aggregation of many generators and a large diversity of loads on a single grid.

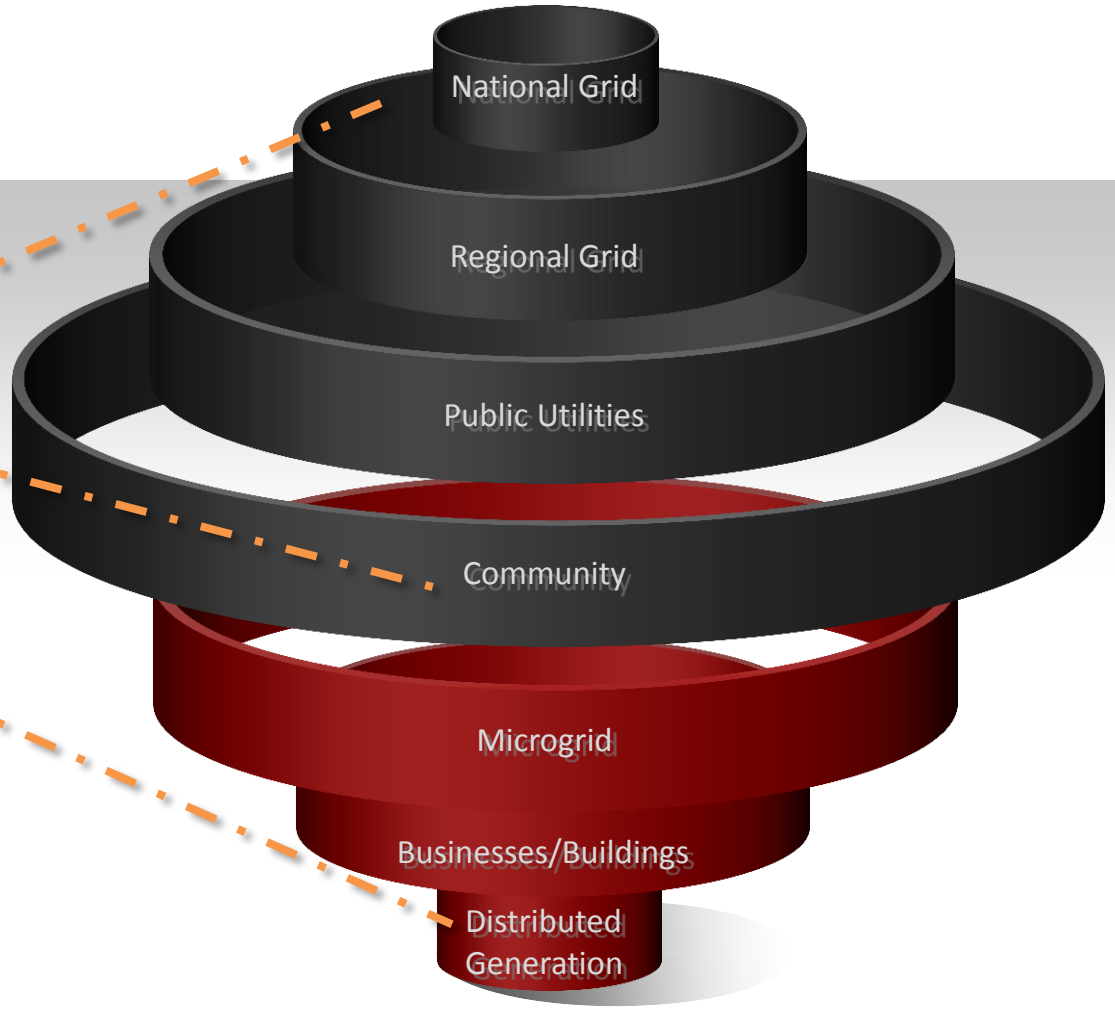


CONTRAST IN SYSTEMS

Smart Grid/Macrogrid
Traditional form of power production

Community Consumption

Microgrid/Smart Building
Generation and consumption are closer which allows for greater efficiency, reliability and demand response



Introduction to Microgrids

- There have been significant changes in technology, regulatory policy, and customer-end use energy needs over the years, which have come together to increase the potential value of microgrids.
  - **Rising Cost and Burdens of T&D Infrastructure:**
    - The difficulty of building new T&D infrastructure has become high in some areas due to permitting issues, public resistance, and the difficulty/cost of upgrading or building new infrastructure.
  - **Better Distributed Generation & Storage Technologies:**
    - Advancements in energy storage along with dropping costs and improved performance of distributed generation technologies (including renewables, internal combustion engines, and small combustion turbines) help to provide cheaper generation, increased energy security and reduced emissions.
  - **Power Quality and Reliability:**
    - The need for high reliability and good power quality has increased as more customers install microprocessor-based devices and sensitive end-use machines.
  - **Public Policy:**
    - In a full reversal from the past, public policy today is favoring distributed generation that offers improved efficiency, lower emissions, enhanced power-system security, and other benefits of national interest. Policies supporting this include tax credits, renewable portfolio standards, emissions restrictions, grants, etc.
  - **More Knowledgeable Energy Users:**
    - Energy users are becoming more aware of alternative power approaches and are more willing to consider onsite generation options than in the past. Many are interested in combined heat and power as well as reliability enhancements.
  - **Increased Interest in Security**

Advantages of Microgrids

- **Increased Reliability:**
  - Ability, during a utility grid disturbance, to separate and isolate itself from the utility seamlessly with little or no disruption to the loads within the microgrid.
- **Improved Efficiency:**
  - Prevents utility grid failure in peak load periods by reducing the load on the grid
  - Close proximity of the generator allows the use of both electricity and heat, increasing overall energy efficiency
- **Penetration of various Renewable Generation:**
  - Provides significant environmental benefits by using low or zero emission generators.
- **Encourages investment by small businesses:**
  - Can be used to mitigate the electricity costs to its users by generating some or all of its electricity needs.

Microgrid Value Streams

- **Economic Value Streams**
  - Reduced Overall Energy Costs
  - Sales of Excess Power to the Macro-Grid
  - Participation in Organized Demand Response Markets
  - Reduced T&D Losses
  - Enhanced Electricity Price Elasticity
- **Reliability and Power Quality Value Streams**
  - Reduced Power Interruptions
  - Enhanced Power Quality
- **Environmental Value Stream**
- **Security and Safety Value Stream**

Microgrid Architectures

- Microgrids can range widely in size, source of generation, source of electricity, heating and cooling…
- Given this diversity and versatility, it is virtually impossible to map out a “typical” microgrid configuration.
- Currently there are leading end-use applications under deployment today:
  - Institutional/Campus Microgrids
  - Military Base Microgrids
  - Remote “Off-Grid” Microgrids
  - Utility/City Center
  - Farming Communities
  - Community Microgrids (Private Investment)

Conclusion

- Actions to increase renewables
  - Move from Centralized to Decentralized
    - Regulatory action required
      - i.e., generation issues, break down barriers to energy markets, allow greater access to electrical grid…
  - Incentivize Small Business Owners, City Leaders, Farming Community to invest in DER
  - Create Microgrid infrastructure to increase system reliability and allow DG:
    - Promote storage
    - Clean energy systems (biomass, PV, other?)
    - Efficiency in consumption

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